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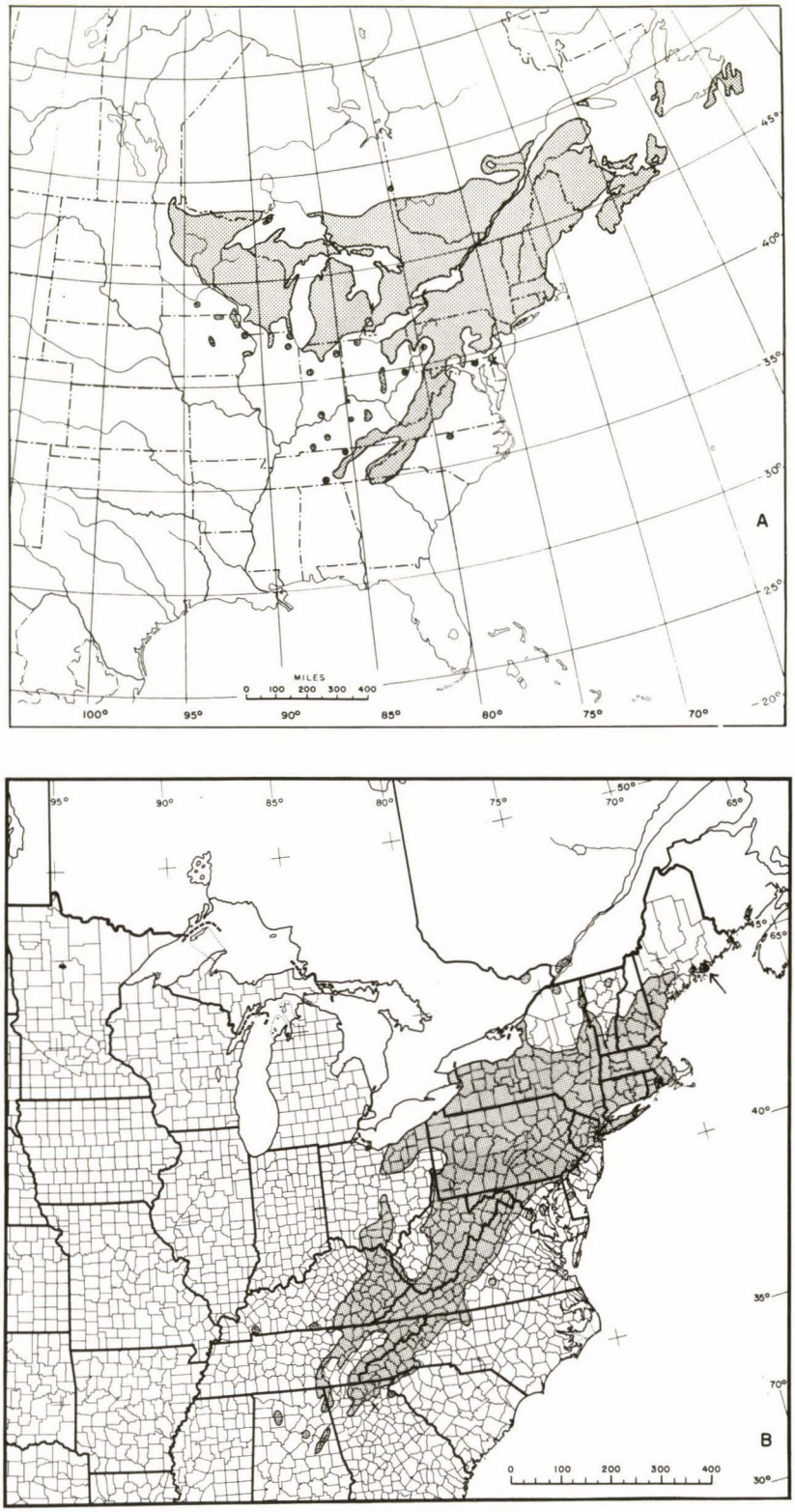


BIRCH

. . . *an American wood*

Birches grow throughout the arctic regions and cooler parts of the north temperate zone. Of the 40 species of trees and shrubs included in the genus ***Betula***, yellow birch, sweet birch, and paper birch are the most important commercially. Birch is used principally for lumber, veneer, pulpwood, fuelwood, and small turned products. Yellow birch, one of the principal furniture woods, is also used in the hardwood distillation industry to produce wood alcohol, acetate of lime, charcoal, tar, and oils. Sweet birch is used to produce birch oil. Paper birch is used for specialty veneer products such as ice-cream sticks, picnic spoons, and tongue depressors, as well as small turned or rived products such as bobbins, spools, broom handles, dowels, shoe shanks, and toys.

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Figure 1.—Natural range of yellow birch (A), sweet birch (B).

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BIRCH

. . . an American wood

Robert L. Brisbin and David L. Sonderman[1]

DISTRIBUTION

Throughout the arctic regions and cooler parts of the North Temperate zone, there are approximately 40 species of trees and shrubs included in the genus *Betula*. Of these species, yellow birch (*Betula alleghaniensis* Britton), sweet birch (*Betula lenta* L.), and paper birch (*Betula papyrifera* Marsh.) are the most important commercially in North America. Other birches of minor commercial importance include gray birch (*Betula populifolia* Marsh.) and river birch (*Betula nigra* L.). Gray birch is found in the northeastern United States and in southeastern Canada. River birch is found through the midwestern and eastern United States.

Yellow birch, the most valuable species of native birch, ranges from New England west to Minnesota and Iowa and southward in the Appalachian Mountains to northern Georgia. In Canada, it extends from Ontario eastward through Quebec to Newfoundland (fig. 1A). The species commonly associated with yellow birch include eastern hemlock, sugar maple, American beech, and red spruce.

Sweet birch grows in New England, New York, New Jersey, and Pennsylvania; and it extends southward along the Appalachian Mountains to northern Georgia and Alabama. In Canada, it occurs in mixed stands from Newfoundland to Ontario (fig. 1B).

Sweet birch grows in association with a large number of hardwood and softwood species. These include eastern white pine, eastern hemlock, white ash, sugar maple, American beech, yellow birch, black cherry, basswood, yellow-poplar, and eastern red cedar.

Paper birch, the most widely distributed of the birches, has a transcontinental range extending throughout Canada to Alaska. In the United States, it occurs eastward from the Lake States to New York and New England. Paper birch is found in scattered areas in many western States as well as in Iowa, Nebraska, the Dakotas, and on a few high mountains in West Virginia and North Carolina (fig. 2). Although paper birch grows in pure stands, it is more commonly found with either red spruce and balsam fir or with yellow birch and white ash.

DESCRIPTION AND GROWTH

Yellow birch in a good environment can grow 60 to 70 feet high and 24 to 30 inches in diameter at breast height. Mature trees usually have long, well-formed trunks with irregularly rounded crowns (see cover). Even though the root system is shallow, the tree is comparatively free from windthrow because the roots extend laterally for considerable distances.

The bark on young stems and branches is golden gray to bronze and peels horizontally into thin, curly, papery strips (fig. 3). On mature trees it breaks up into reddish-brown plates.

Yellow birch leaves are 3 to 4½ inches long, irregularly saw-toothed, and elliptical in shape (fig. 4). The upper leaf surface is dull dark green; the lower surface is pale yellow green with tufts of pubescence.

Yelow birch bears male and female flowers on the same tree (fig. 4). The fruit is a short-stocked, conelike structure in which many minute two-winged nutlets (seeds) develop.

Yellow birch is a moderately prolific seeder, usually producing some seed each year and large crops at irergular intervals. Germination occurs on almost any moist site, including moss-covered boulders and old partially rotted stumps. Excellent seedbed conditions are created by such disturbances as logging, fires, and windthrow if there is partial protection from the sun and wind.

Yellow birch is moderately tolerant, but less so than sugar maple and American beech. However, it is the most tolerant of the birches native to eastern North

[1] Research forest products technologists, U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station.

NOTE.—This publication supersedes unnumbered publication *Birch*, issued 1945.

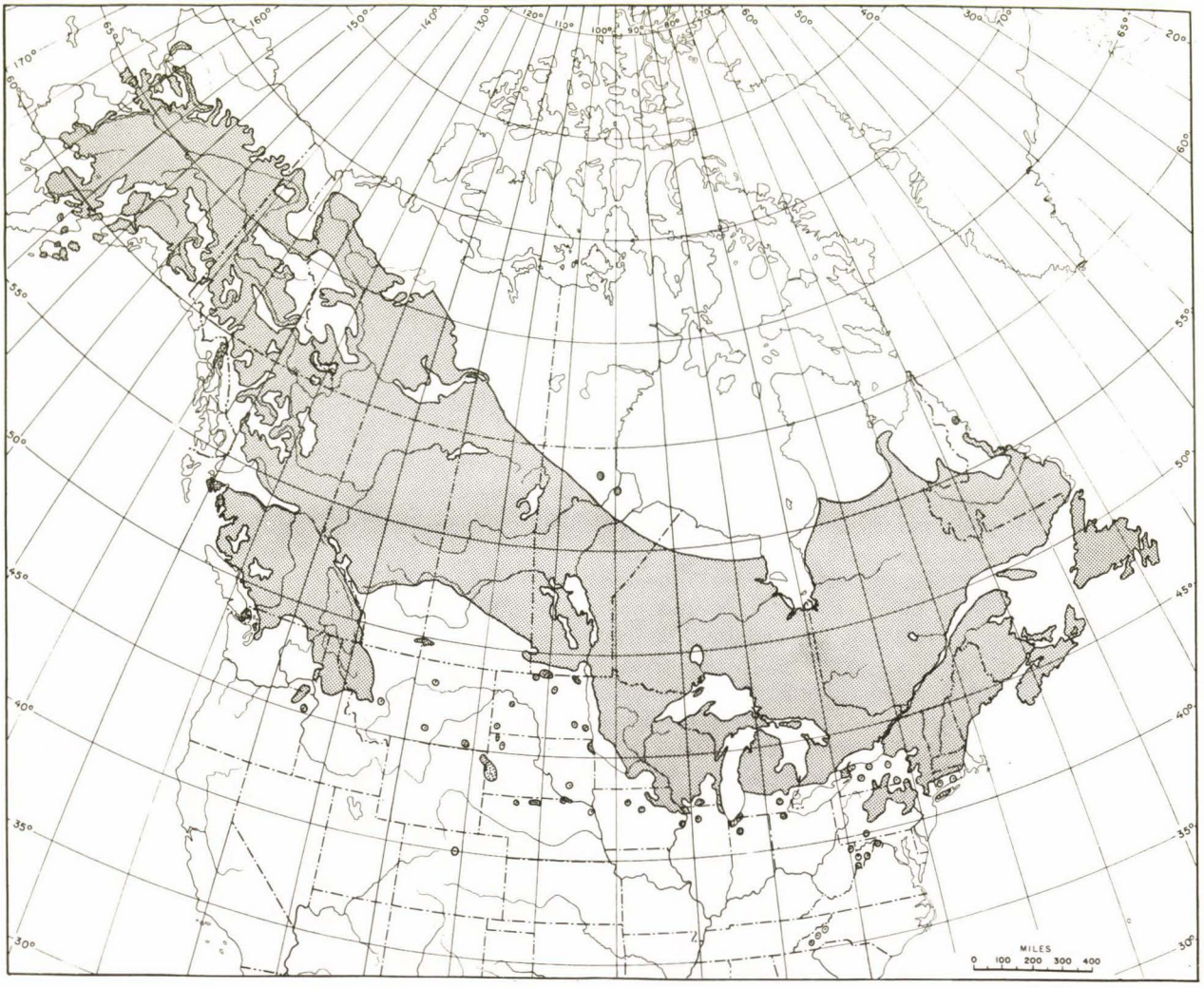


Figure 2.—Natural range of paper birch.

America. It is represented in many climax types of northern forests but tends to give way with age to more tolerant species on dry sites. Growth is moderately slow, and maturity is reached in 120 to 150 years. It is not uncommon to find yellow birch trees over 300 years old. The largest yellow birch on record is 54 inches in diameter at breast height and 90 feet high, with a 64-foot crown diameter.

Young yellow birch trees are sometimes found growing on top of boulders and old tree stumps, causing root exposure and extreme susceptibility to light ground fires and mechanical damage. Older trees, having thin and highly flammable bark, may also be seriously injured by light fires.

Yellow birch has several insect enemies. The bronze birch borer, *Agrilus anxius*, weakens the tree by tunneling in the wood and may cause death. The birch skeletonizer, *Bucculatrix canadensisella*, feeds on the leaves and denudes the tree. Of equal importance is the forest tent caterpillar, *Malacosoma disstria*, which can kill the trees by continual defoliation.

Yellow birch is also susceptible to various heart rots and diseases. The false tinder fungus, *Fomes igniarius*, is commonly found on live birches; and the tinder fungus, *Fomes fomentarius*, is common on dead birches but may attack living trees. More serious is the stem canker, *Nectria galligena*, which reduces the quality of the main stem and increases the chances of wind breakage and disease infestation.

A condition known as birch dieback has caused considerable damage to yellow birch throughout its natural range. No single factor has been known to cause the disease, but many believe that a climatic change leading to increased soil temperature causes rootlet mortality and kills the tree. Usually associated with the dieback is the bronze birch borer, which often kills the weakened tree.



F-243135

Figure 3.—Typical bark on young yellow birch.

Paper birch is a comparatively short-lived tree that matures early—generally at 70 to 80 years of age. Mature trees are usually 50 to 70 feet high and have a diameter of 12 to 24 inches. The crown is usually pyramidal at an early age and later becomes irregularly rounded and open (fig. 5). Records show that the largest paper birch is 42 inches in diameter and 96 feet high. The root system of paper birch, like yellow birch, is shallow and wide-spreading.

It prefers a fairly deep, loose, well-drained, sandy-loam soil. It is not likely to grow on dry, sandy barrens or in submerged swamps, but it is usually found growing in situations intermediate between these two extremes.

Paper birch is one of the most intolerant species of the Northeast. Young seedlings will grow under very light shade, but will not survive under a heavy crown cover. Among its common associates in the Northeast, only aspen, pin cherry, and gray birch are more intolerant.

It can be recognized by its creamy white bark that separates readily into thin papery layers (fig. 6). On older trees, the bark at the base of the stem is characterized by deep black fissures.

The leaves of paper birch are 2 to 3 inches long, oval-shaped (fig. 7), and the same color as yellow birch leaves; the seed-bearing fruit of both species are similar (fig. 7).

Paper birch, a more prolific seeder than yellow birch, produces good seed crops on some trees almost every year. Under favorable conditions, such as in bare mineral soil or on rotten logs, the germination percent of paper birch seed may be high (60 to 80 percent). However, a heavy ground cover of leaves, duff, or sod may discourage reproduction and, in many cases, prevent it altogether.

By far the worst enemy of paper birch is fire. Young seedlings and saplings are destroyed by light ground fires; and older trees, with their papery bark, are highly flammable and very susceptible to serious injury or death. Paper birch is also susceptible to the same diseases and insect attacks as yellow birch.

Sweet birch is a medium-sized tree 12 to 24 inches in diameter and 50 to 60 feet tall. On a good site the tree develops a long, clear bole that has a rather deep, wide-spreading root system. The tree is often found on rocky sites where the roots grow over and around boulders and rocky ledges. Moist, protected northerly or easterly slopes are most favorable for best growth. The largest tree on record is 58 inches in diameter at breast height and 70 feet tall.



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Figure 4.—Leaves and flowers of yellow birch.



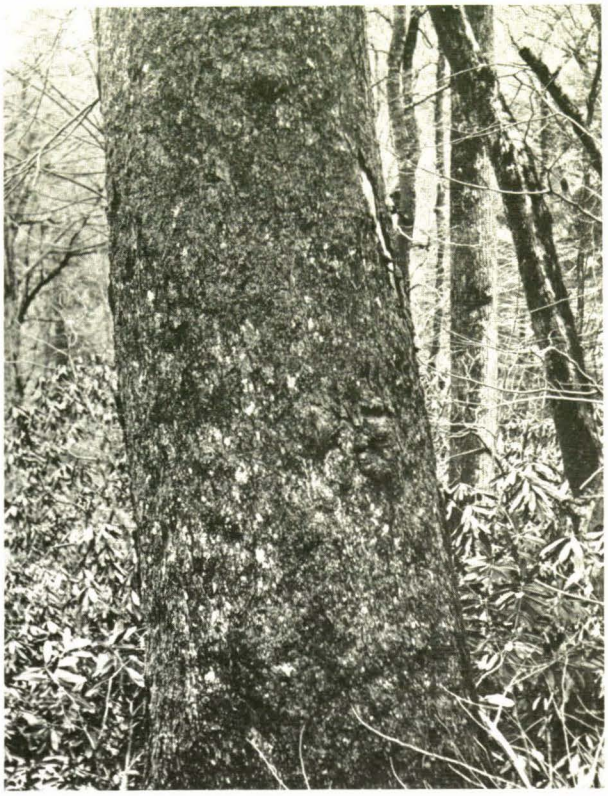
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Figure 5.—Mature paper birch.



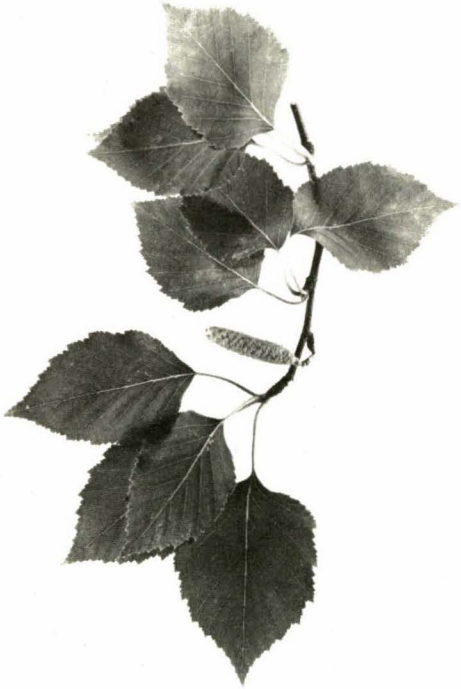
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Figure 6.—Bark on young paper birch.



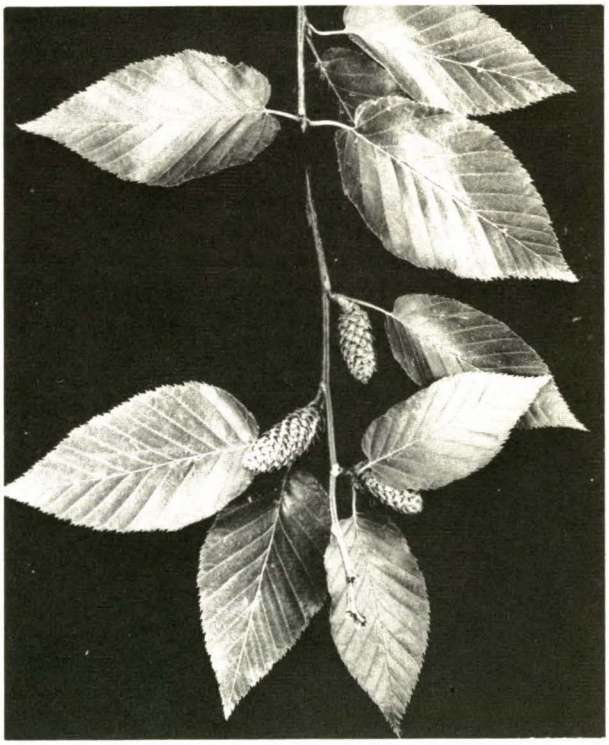
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Figure 8.—Bark of mature sweet birch.



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Figure 7.—Leaves and fruit of paper birch.



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Figure 9.—Leaves and fruit of sweet birch.

Sweet birch twigs are light reddish-brown with a strong wintergreen odor and taste. The bark on young trees is reddish brown to nearly black, with horizontal lenticels. On mature trees the bark is brownish black and breaks up into large thin irregular scaly plates (fig. 8).

The leaves of sweet birch are 2½ to 5 inches long and oval-shaped with uniformly serrated edges (fig. 9). Leaf color and fruit characteristics of sweet birch are similar to both yellow birch and paper birch.

Seed production begins when the tree is about 40 years old, and good seed crops occur every 1 or 2 years. Sweet birch is similar to the other birches in seedbed requirements, but it is not so exacting as yellow birch in choice of seedbed sites. Deep, rich, moist soil is best for good sweet birch germination. The species is a prolific sprouter from small stumps, as are most of the birches.

Several fungi attack sweet birch at an early age, causing severe stem damage. The most important pathogens are white trunk rot, *Fomes igniarius*, and Nectria canker, *Nectria galligena*, which cause serious cankers on the tree stem. Of the leaf-feeding insects that occasionally infest sweet birch, the birch skeletonizer is the most serious. Fire also takes its toll of sweet birch because the tree has extremely thin bark. Even a light scorching at the base of the tree will lower its resistance to insect and fungal infestation.

COMMON NAMES

Yellow birch is the common name normally used for *Betula alleghaniensis*. Other common names include gray birch, silver birch, and swamp birch.

Betula papyrifera is commonly known as paper birch or white birch, depending on its locality. Other common names are canoe birch and silver birch.

Betula lenta is known as sweet birch or black birch. In some localities, it is also called cherry birch.

It is interesting to note that in some localities several different species of birch have the same common name.

RELATED COMMERCIAL SPECIES

The three commercially important birches are combined and called birch in many lumber- and veneer-production reports. Other reports separate yellow birch and combine sweet birch and paper birch with several other hardwood species. In individual State resource estimates, the three birches may be shown separately if the volumes present in the State justify a separation. Pulpwood production reports commonly combine the birches with beech and maple.

SUPPLY

The total volume of yellow birch in the United States is estimated to be about 3.6 billion cubic feet. About one-half of this volume (8.5 billion board feet) is in trees of sawtimber size. The largest volumes of yellow birch sawtimber are located in Maine, Michigan, and New York. Other States having more than 100 million board feet of yellow birch sawtimber are New Hampshire, Wisconsin, Vermont, West Virginia, Pennsylvania, Connecticut, and Massachusetts.

According to recent Forest Survey reports, the general quality of yellow birch sawtimber is low. For example, the 1966 forest survey of Vermont and the 1968 forest survey of New York showed that only 15 percent and 19 percent, respectively, of the sawtimber volume was in log grade 1.

The largest supplies of yellow birch on the North American continent are in Canada. Quebec, Ontario, New Brunswick, and Nova Scotia have about 25.5 billion board feet of yellow birch sawtimber.

The United States (Alaska included) is estimated to have about 7 billion cubic feet of paper birch. The greatest percentage of this volume is in small poletimber-sized trees. The paper birch sawtimber volume is estimated to be about 6 billion board feet. About 42 percent of this volume is in Alaska, 34 percent is in the Northeastern States, 23 percent is in the Lake States, and 1 percent is in the Pacific Northwest States. Canada has about 34 billion board feet of paper birch sawtimber. About 80 percent of this volume is in Quebec and Ontario.

In most timber resource statistics, sweet birch is combined with other minor commercial hardwood species. Therefore, it is difficult to obtain accurate supply data for the species. However, recent State forest survey reports indicate that West Virginia, New York, Vermont, Massachusetts, and Pennsylvania have about 800 million cubic feet of sweet birch. About 1 billion board feet of this volume is of sawtimber size. West Virginia and Pennsylvania have the largest volumes; lesser amounts of sweet birch are found in southwest Maine, New Hampshire, western Virginia, and western North Carolina.

PRODUCTION

Birch lumber production increased from 183 million board feet in 1899 to a maximum of 452 million board feet in 1909. After 1909, an irregular but gradual drop in production occurred until 1929 (fig. 10). In 1932, birch lumber production reached a low of 73 million board feet. A combination of the economic depression of the 1930's and a disease known as birch dieback probably accounted for the sharp drop. Production gradually increased again to a high of 215 million board feet in 1941. Since 1941, it has gradually decreased. As of 1969, according to the Bureau of the Census, the volume of birch lumber produced was 88 million board feet.

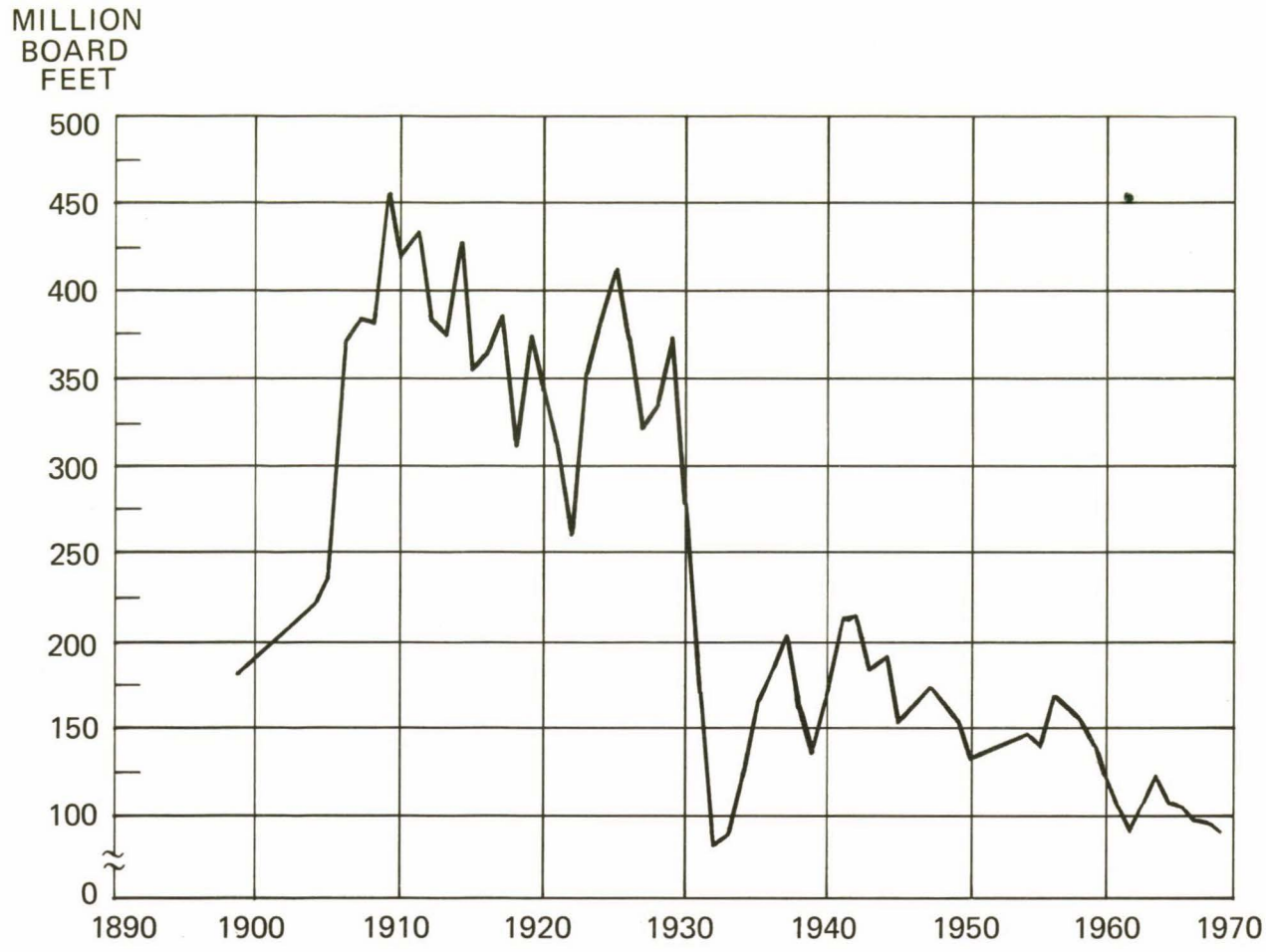


Figure 10.—Birch lumber production, 1899–1969.

Most lumber production reports do not distinguish among the three commercially important birch species. However, it is estimated that the greater part of birch lumber production is yellow birch.

The volume of birch logs used for veneer was estimated to be about 13 million board feet log scale in 1905. By 1943, the volume of birch used had risen to 76 million board feet. This sharp increase in production resulted primarily from the demand for aircraft veneer during World War II. The veneer used in the British "Mosquito" bomber was nearly all birch.

In 1968, about 68 million board feet of birch logs were used for veneer. About 85 percent of this volume was produced in the Northeastern States, of which Maine contributed the most. The other 15 percent was produced in the Lake States, of which Michigan was the largest producer. Several Southern States also produced minor amounts of birch veneer logs.

During the period from 1931 to 1940, the average annual consumption of birch pulpwood was estimated to be about 52,000 standard cords. An unofficial estimate for 1944 placed the production of birch pulpwood at 27,000 cords.

Production reports for 1969 show that 88,623 cords of birch pulpwood were produced in the Lake States. Wisconsin produced over 75 percent of this volume. In the 1969 report for the Northeastern States, production is shown only for the combined species of birch, beech, and maple. However, unofficial estimates show that birch pulpwood production in the Northeastern States may have exceeded 250,000 cords. Maine produced over one-half of this volume. Total birch pulpwood production in the United States during 1969 probably approached 350,000 cords.

In past years, substantial amounts of birch have been used in the cooperage, crosstie, and hardwood-distillation industries. In 1937, the amount of birch used in the hardwood-distillation industry was estimated at about 114,000 cords. Although current production figures are not available, this use of birch has decreased because of the availability of synthetic chemicals. Other prod-

ucts manufactured from birch for which accurate production figures are not available include fuelwood and boltwood for small specialty products.

CHARACTERISTICS AND PROPERTIES

The three commercially important birches cannot be separated from each other with certainty on the basis of the gross structure or minute anatomy of the wood. The growth rings of all three birches are difficult to see without the aid of a magnifying glass.

The wood of yellow and sweet birch is relatively heavy, hard, and strong; and it has high shock-resistance. Yellow birch wood weighs about 43 pounds per cubic foot at 12-percent moisture content; sweet birch wood weighs about 46 pounds per cubic foot. Sweet birch is ranked slightly above yellow birch in most strength properties. The wood of both species has a fine, uniform texture and is capable of taking a high-gloss finish.

The wood of paper birch also has a fine, uniform texture; however, it is considerably lighter than the other two birches and ranks below them in hardness, strength, and stiffness. The average weight of paper birch wood at 12-percent moisture content is about 38 pounds per cubic foot. Paper birch turns well in a lathe, and the surface of the wood has a smooth, white appearance.

All of the birches shrink considerably during drying. Paper birch is relatively easy to dry, whereas yellow birch must be dried carefully to prevent checking and warping. Birch lumber has a tendency to split during nailing; but once it is nailed without splitting, the nail-holding ability of the wood is excellent. The heartwood of the birches has a moderate-to-low resistance to decay. Paper birch is relatively easy to work with handtools. Sweet and yellow birch are difficult to work with handtools but can be readily shaped by machine. Because sweet and yellow birch are difficult to glue, special veneer and adhesive treatments are usually required to obtain the best results. They are glued more easily with synthetic-resin glues than with natural glues.

The birches may be pulped by practically all of the commercial pulping processes—mechanical, chemical, or semichemical. However, birch pulp produced by the mechanical process is not well suited for most uses because of short fiber length and low pulp strength. Birch may be pulped by all three of the chemical methods—sulfite, sulfate, and soda—but the best yields and strength properties result from the sulfate method. The relatively new semichemical pulping processes are particularly well adapted for pulping the birches, as well as most other hardwoods. The two semichemical methods—cold soda and chemigroundwood—produce a higher yield of pulp by weight than the chemical methods, and there is only a small decrease in strength properties.

PRINCIPAL USES

Birch is used principally for lumber, veneer, pulpwood, fuelwood, and small turned products. In past years, substantial amounts have been used for railroad crossties, barrel staves, and chemical distillation products.

Yellow birch and sweet birch lumber and veneer are used in the manufacture of furniture, cabinets, boxes, woodenware, handles, and millwork, such as interior finish and flush doors. Yellow birch is one of the principal furniture woods in the United States because of its good machining and finishing properties, hardnesss, pleasing figure, and attractive color.

Yellow birch is also one of the principal woods used in the hardwood-distillation industry to produce wood alcohol, acetate of lime, charcoal, tar, and oils. Sweet birch bark is used to produce birch oil, which is identical to wintergreen oil. This oil is generally more abundant in birch bark than in the natural wintergreen plant. Because of the introduction of synthetic products, the use of birches in the distillation and birch oil industries has declined in the past several years.

Large amounts of paper birch are used for specialty veneer products and small turned or rived products. The veneer products include ice cream sticks, picnic spoons, tongue depressors, and toothpicks. Paper birch is well suited for these products because it has a uniform texture, a smooth white appearance, and no odor or taste. Most of the paper birch turned or rived products are produced at plants in New England and the northern Lake States. These products include bobbins, clothespins, spools, broom handles, dowels, shoe shanks, shoe pegs, and toys.

In various localities of the United States, substantial quantities of birch are used for fuelwood. Because paper birch firewood is attractive, it is sought after in the growing market of luxury fireplace wood.

Paper pulp made from birch is used in varying amounts with other pulps to produce such products as boxboards, book and newsprint paper, paper toweling, and corrugated paper.

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